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| 10/643,944      | 08/20/2003  | Yoshiaki Hasegawa    | 63979-032           | 3843             |

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Washington, DC 20005-3096

| EXAMINER |
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VAN ROY, TOD THOMAS

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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2828

DATE MAILED: 11/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                                               |                                 |  |
|------------------------------|-----------------------------------------------|---------------------------------|--|
| <b>Office Action Summary</b> | Application No.<br>10/643,944                 | Applicant(s)<br>HASEGAWA ET AL. |  |
|                              | Examiner<br>Tod T. Van Roy <i>[Signature]</i> | Art Unit<br>2828                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on 03 October 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                                        |                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                            | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____                                                |

## **DETAILED ACTION**

### ***Priority***

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Specification***

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### ***Response to Amendment***

The examiner acknowledges the amending of claims 1, 3, 5-6, and 13, as well as the addition of claim 15, and cancellation of claim 2.

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-14 have been considered but are moot in view of the new ground(s) of rejection.

Claim 15 will be addressed in the rejection of the claim.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 6-7, and 10-13 are rejected under 35 U.S.C. 102(b) as being anticipated by Akitaka et al. (JP 10-200214 A, applicant submitted prior art).

With respect to claim 6, Akitaka discloses a semiconductor laser in which an n-type semiconductor layer (fig.1 #103), an active layer (fig.1 #107), and a p-type semiconductor layer (fig.1 #109) are stacked in this order on a substrate (fig.1 #101); the semiconductor laser comprising an intermediate layer (fig.1 #108, 114) sandwiched between the active layer and the p-type semiconductor layer and composed of a gallium nitride-based compound semiconductor ([0015], AlGa<sub>N</sub>, GaN); the intermediate layer having a stacked structure comprising an un-doped layer including no intentionally added impurities (#108 [0015] no dopants added) and a diffusion-blocking layer doped with an n-type impurity (#114 [0015]); and the diffusion-blocking layer being located at a side adjacent to the p-type semiconductor layer (fig.1).

With respect to claim 7, Akitaka discloses the laser device as outlined in the rejection to claim 6, and further discloses the concentration of the n-type impurity in the diffusion-blocking layer ([0028] 1E18cm<sup>-3</sup>, last line), is about the same or higher than that of the p-type impurity in the p-type semiconductor layer ([0028] 3E17cm<sup>-3</sup>, 4<sup>th</sup> line).

With respect to claim 10, Akitaka discloses the laser device as outlined in the rejection to claim 6, and further discloses the thickness of the diffusion-blocking layer ([0015] 20nm) to be between 1/11 and 11 times the thickness of the undoped layer ([0015] 20nm; making the diffusion blocking layer 1 times the undoped layer)

With respect to claim 11, Akitaka discloses the laser device as outlined in the rejection to claim 10, and further discloses the intermediate layer to be not less than 15nm and not more than 180nm (from rejection 10- 20nm+20nm =40nm).

With respect to claim 12, Akitaka discloses the laser device as outlined in the rejection to claim 6, and further discloses the active layer to comprise a well layer composed of InGaN ([0016]).

Claim 13 is rejected for the same reasons as claim 6. This claim merely details the methods of forming the device. The method of forming a device is not germane to the patentability of the device itself, therefore these limitations are not given patentable weight. At best these claims could be characterized as product-by-process claims, where the process limitations are not limiting, only the structure implied by the process. See MPEP 2113. Here, the structure implied by the process steps is merely the structure of claim 6.

Claim 15 is rejected under 35 U.S.C. 102(b) as being anticipated by Nakamura et al. (US 5959307).

With respect to claim 15, Nakamura discloses a semiconductor laser in which an n-type semiconductor layer (fig.2 #13), an active layer (fig.2 #16), and a p-type

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semiconductor layer (fig.2 #103) are stacked in this order on a substrate (fig.2 #11); the active layer comprising a well layer composed of InGaN (col.6 lines 13-17); the semiconductor laser comprising an intermediate layer (fig.2 #101) sandwiched between the active layer and the p-type semiconductor layer; and the intermediate layer including no intentionally added impurities (col.7 lines 9-10) and being composed of a gallium nitride-based compound semiconductor (col.7 lines 2-9), and the thickness of the intermediate layer being not less than 60nm and not more than 160 nm (col.7 lines 44-46, 100nm or less to 30nm – falls in claimed range, also, Nakamura does teach that using a thickness greater than 50nm may be not be preferred, but this reasoning is stated in the case when  $\text{Al}(j)\text{Ga}(1-j)\text{N}$  where  $J \geq .2$ , since the applicant's claim does not specify the ratios of the elements Nakamura must still then read on a possible embodiment of the claim, i.e. when  $J < .2$ ).

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, and 3-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Kozaki et al. (US 6711191).

With respect to claim 1, Kozaki discloses a semiconductor laser in which an n-type semiconductor layer (col.23 lines 45-55), an active layer (col.23-24 lines 60-8), and

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a p-type semiconductor layer (col.2 lines 54-55) are stacked in this order on a substrate (col.23 lines 24-25); the active layer comprising a well layer composed of InGaN (col.23 line 64); the semiconductor laser comprising an intermediate layer (col.24 lines 29-31) sandwiched between the active layer and the p-type semiconductor layer; and the intermediate layer including no intentionally added impurities (taught to be undoped) and being composed of a gallium nitride-based compound semiconductor (GaN), and the intermediate layer being composed of GaN.

With respect to claim 3, Kozaki discloses the laser device outlined in the rejection to claim 1, and further discloses the semiconductor laser is a group III-V nitride laser (col.23-24 lines 18-67), the n-type semiconductor layer contains Si as an n-type impurity (col.23 lines 45-50), and the p-type semiconductor layer contains Mg as a p-type impurity (col.24 line 55).

With respect to claim 4, Kozaki discloses the laser device outlined in the rejection to claim 1, and further discloses the concentration of the p-type impurity in the active layer is about  $1E17\text{ cm}^{-3}$  or lower (col.23 line 64, free of p-type dopants).

Claim 5 is rejected for the same reasons as claim 1. This claim merely details the methods of forming the device. The method of forming a device is not germane to the patentability of the device itself, therefore these limitations are not given patentable weight. At best these claims could be characterized as product-by-process claims, where the process limitations are not limiting, only the structure implied by the process. See MPEP 2113. Here, the structure implied by the process steps is merely the structure of claim 1.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akitaka in view of Yoshie et al. (US 6580736).

With respect to claim 8, Akitaka teaches the laser device as outlined in the rejection to claim 6, but does not teach the diffusion-blocking layer to have an n-type concentration of not less than  $1\text{E}19\text{cm}^{-3}$  and not more than  $6\text{E}19\text{cm}^{-3}$ . Yoshie teaches a Gallium-Nitride based semiconductor laser device comprising a similarly stacked, and ordered structure (fig.5) wherein the gallium-nitride based intermediate layer (fig.5 #19a,b) forms a current blocking layer, with n-type doping of  $1\text{E}19\text{cm}^{-3}$  (table 2, 19b), which inherently acts as a diffusion-blocking layer due to the high doping (impeding



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impurity flow), layer placement (between active region and p-type dopant layers), and thickness (table 2, 19b). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser structure of Akitaka with the current-blocking layers of Yoshie to confine drive current to a given device region, controlling leakage current, and reducing threshold current (Yoshie, col.11 lines 13-28).

With respect to claim 9, Akitaka and Yoshie teach the laser device as outlined in the rejection to claim 8, and further teach the n-type dopant to be Si (Akitaka, [0015]) and the p-type dopant to be Mg (Akitaka, [0015]).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akitaka in view of Tojyo et al. (Tojyo, Tsuyoshi., et al. "GaN based High Power Blue Violet Laser Diodes." The Japan Society for Applied Physics, Volume 40. Pad 1. No. 5A, May 2001, pp.3206-3210).

With respect to claim 14, Akitaka teaches the process for manufacturing the laser device as outlined in the rejection to claim 13, but does not teach selectively growing a nitride-based compound semiconductor layer in the lateral direction on the substrate. Tojyo teaches a Gallium-Nitride based device wherein the step of forming the n-type semiconductor layer on the substrate is performed after selectively growing a nitride-based compound semiconductor layer in the lateral direction on the substrate (col.1-2 lines 38-7). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser manufacturing method of Akitaka with the selective

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lateral growth technique of Tojyo to reduce density dislocations and improve device lifetime (Tojyo, col.1 lines 10-12).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR

  
